UNITED STATES ARMY **GD10FM**
FIELD ARTILLERY SCHOOL **LP**
Fort Sill, Oklahoma **SEP 97**

LESSON PLAN

REVIEW/APPROVAL: **Name:** **Date:**

INSTRUCTIONAL UNIT: Fire Mission Processing - (Manual)

CLEARANCE: Unclassified

ACCESS: No foreign students allowed to attend (NOFORN)

CRITICAL TASKS TAUGHT: 061-280-5001 Process Fire Missions In Degraded Mode (Manual)

TYPE: Conference and Practical exercises

TIME ALLOTTED: 50 hours (1C 49 PE1)

CLASS PRESENTED TO: Cannon Fire Direction Specialist

TOOLS, EQUIPMENT, AND MATERIALS: 3 blank records of fire.

PERSONNEL: One Primary Instructor and sufficient assistant instructors to maintain student/equipment ratio

TRAINING AIDS: Call for fire (L3608 or L439), Fire order (TC 6-5-34), Message to observer (L399), Fire commands (L2725) Initial/Subsequent fire commands (L6-5-65)

REFERENCES: FM 6-40

STUDY ASSIGNMENTS: Read FM 6-40 Chapter 9 and 10

STUDENT UNIFORM AND EQUIPMENT:

Uniform: Duty

Equipment: Bring Rimms Issue

TROOP REQUIREMENT: None

ADVANCE ARRANGEMENTS: The classroom and equipment will be prepared NLT 30 MINUTES before the scheduled lesson.

TIME CONTROL: 50 hours. Minor deviations from the schedule **made** be made if necessary.

RISK ASSESSMENT RATING APPROVAL: Low

REVIEWED BY DIVISION CHIEF:_____DATE:

REVIEWED BY FABSO:_____DATE:

Section I

INTRODUCTION

1. ATTENTION STEP:

The fire direction center is the link between the observers and the howitzers (line of metal). When a mission is received from the observer there is a number of things that need to happen rapidly without error for us to provide timely an accurate fire.

2. NEED TO KNOW:

The fire direction center would be of little value if the members within it could not work as a team with their knowledge into what we will learn today as the operations of the fire direction center. There are four messages vital to the processing of missions in the FDC.

1. The call for fire (CFF),
2. The fire order (FO),
3. The message to observer(MTO),
4. The fire commands (FC).

Upon receiving a call for fire the success or failure of the FDC lies within its ability to rapidly interpret and compose a fire order, message to observer, and fire commands. We will examine these messages in the order in which they would be determined in the FDC.

3. TERMINAL LEARNING OBJECTIVES:

Given established data, fire mission messages, current GFT, GST, TFT, addendum, DA Form 4504 Record of Fire Form, and FM 6-40; Process fire mission in degraded mode IAW procedures in FM 6-40.

4. SAFETY STATEMENT:

Safety precautions have been reviewed and are not applicable.

5. RISK ASSESSMENT:

TASK: Low

6. ENVIRONMENTAL CONSIDERATIONS:

None

7. PREREQUISITES:

Must have successfully completed instruction on chart data, basic firing data and site.

Section II

EXPLANATION

INSTRUCTOR NOTE: Show and explain each member of the FDC's organization on slides as a review of the chart class where they had the members of the FDC briefly explained to them.

DUTIES IN THE MANUAL FDC.

1. FIRE DIRECTION OFFICER is responsible for all actions of the FDC. The FDO concerns himself primarily with evaluating the calls for fire and issuing the fire order.

2. CHIEF CMPTR is the technical expert in the FDC. He provides technical guidance to the FDO and supervises the operation of the FDC and the FDC personnel. The CHIEF CMPTR is capable of performing the duties of the FDO during missions.

3. COMPUTER determines firing data composes fire commands and transmits fire commands to the guns. The computer maintains a record of the mission on the record of fire.

4. HORIZONTAL CONTROL OPERATOR constructs the primary firing chart and determines and announces chart data.

5. VERTICAL CONTROL OPERATOR constructs the secondary chart and checks chart data announced by the HCO. Computes site, angle of site and vertical interval as well as plots targets on sit map to determine and announce their altitude. Maintains sit map to include situation, fire capabilities and dead space.

6. RADIO/TELEPHONE OPERATOR sets up and operates the radio equipment in the FDC. He determines and announces the MESSAGE TO OBSERVER.

ELO(1) Identify record of fire entries 061-280-5001

CALL FOR FIRE

1. The call for fire is a sequence of information divided into six parts and transmitted in three transmissions. The CFF allows the observer to identify and request fire on a target. It provides the location as well as critical information that allows the FDO to decide how to attack the target.

1. Observer Identification
2. Warning Order
3. Target Number
4. Target Description

INSTRUCTOR NOTE: These elements are ordered to assist the FDC in its processing of the mission. Drop demo's of call for fire and explain each of the elements.

THE FIRST TRANSMISSION

Observer identification and the warning order

The observer identification establishes communications with the FDC and identifies the observer to the FDC. Unique to artillery call for fire, once the call signs have been used in the identification, further transmissions need not be prefaced with the call signs.

The warning order follows the observer identification. The warning order tells the FDC how the observer wishes to bring fire onto the target, size of the unit to fire in effect and the method of target location.

TYPE OF MISSION

(1) **Adjust fire (AF)** indicates the observer believes that the FDC will not have effect on target on the first round. This usually results from inaccurate target location or inaccurate firing data. Adjust fire missions should only be used to engage targets that will not "flee" as they are adjusted on.

(2) **Fire for effect (FFE)** is the preferred method of attack since it allows surprise fires to be brought to bear against the target.

(3) **Suppression (S)** indicates a request for fire on a pre-planned target.

(4) **Immediate suppression (IS)** is used when a friendly force is under fire and the observer is willing to sacrifice accuracy for speed in delivery.

The intent is to cause the enemy to take cover or not be able to effectively use his weapons. The fire only has effect as it is delivered.

SIZE OF THE UNIT TO FIRE FOR EFFECT

Is announced when the observer wants to mass fires on a target. In such cases, the type of mission is followed by BATTALION as in D88 de H45, AF, (BNs CALL SIGN). If this element is not addressed, Platoon is the understood unit to fire in effect.

METHOD OF TARGET LOCATION

(1) **POLAR** is announced if a POLAR target location follows. This allows the HCO and VCO to prepare for such a location.

(2) **SHIFT** followed by the point to be shifted from, is sent to allow the HCO and VCO to prepare for a shift target location.

(3) **GRID** is assumed, if no method of target location is addressed.

THE SECOND TRANSMISSION

The target location is the sole element announced in the second transmission. This will be:

1. GRID location providing
   (A) 6 digit grid* (Area Fire Mission)
   (B) 8 digit grid* (Precision Fire Mission)

*Note that direction can be sent with the call for fire or with the 1ST subsequent corrections.

2. POLAR location providing:
   (A) Direction to the target,
   (B) Distance to the target,
   (C) Difference in height between the observer and target if it exceeds 35 meters given as an up or down to nearest 5 meters.
   (D) Difference in height between the observer and target expressed in mils as a positive or negative vertical angle.

3. SHIFT location providing:
   (A) Grid direction to the target,
   (B) Lateral shift from the known point to within 10 meters.
   (C) Range shift from the known point to the nearest 100 meters.
   (D) Difference in height between the known pt and target if it exceeds 35 meters given as an up or down to nearest 5 meters.

THE THIRD TRANSMISSION

The third transmission consists of target description, method of engagement and method of fire and control.

TARGET DESCRIPTION

This tells the FDO/CHIEF CMPTR the vital information for selection of ammunition. The target description tells:

(1) What the target is,
(2) What the target is doing,
(3) The number of elements in the target,
(4) Degree of protection,
(5) Size of the target (Length, width, and attitude).

METHOD OF ENGAGEMENT

Indicates how the observer wishes to attack the target. (1) Type of adjustment -

(A) Precision fire is indicated by the announcement "DESTRUCTION".
(B) Area fire is understood if no announcement is made.

(1) Danger close is announced when target is within:

600 meters for artillery
750 meters for NGF 5" or smaller
1000 meters for NGF 16" guns.
2000 meters for NGF 16" ICM

INSTRUCTOR NOTE: Explain each danger close distance.

(b) Mark indicates the observer wants the FDC to provide a round fired for the purpose of orientation or to indicate targets to ground troops, aircraft, or fire support.

(c) Trajectory allows the observer to select "HIGH ANGLE". No announcement indicates that low angle fire is requested.

INSTRUCTOR NOTE: Explain briefly high angle fire using board drawing as an aid during explanation.

(d) Ammunition is the choice of shell fuze the observer prefers to use in the fire for effect phase of the mission.

The observer will identify HE by the fuze and other projectiles by projectile only. This is based on the fact that most projectiles have a single associated fuze type normally fired with that projectile.

INSTRUCTOR NOTE: Emphasize that the high explosive projectile is compatible with a variety of fuzes which makes this the most flexible for use by the observer.

If no request is made HE/Q is understood.

(e) Volume of fire allows the observer to request a number of rounds (per tube) in effect. No announcement is understood to be 1 round.

INSTRUCTOR NOTE: Explain that in the artillery circling a number identifies it as the number of rounds, and that they will see this many times during the class, when amounts of rounds are talked about and placed on forms.

(f) Distribution is the pattern of bursts in the fire for effect. If no announcement is made, the implied sheaf depends on the method of computation the FDC uses. Using manual techniques a parallel sheaf is normally fired.

INSTRUCTOR NOTE: Using slides explain the different types of sheaf.

METHOD OF FIRE AND CONTROL

(1) Method of fire:

PLATOON adjustment (two pieces) may be requested when adjusting at great ranges to provide a larger burst to spot. Both pieces fire at the same time for each correction.

BTRY/PLT RIGHT (LEFT) is used to adjust the sheaf. The observer may specify the interval between shots.

No request in either of these elements assumes standard adjustment with one gun.

(2) Method of control:
Allows the observer to control the time of firing or cause fires to be ceased. No announcement is assumed to request "when ready".

(A) At my command
(B) Cannot observe
(C) Time on target

INSTRUCTOR NOTE: Explain the different methods of sending a mark time to the FDC in which rounds are to impact +/- 3 seconds there of.

(D) Continuous illumination
(E) Coordinated illumination
(F) Cease loading
(G) Check firing
(H) Continuous fire
(I) Repeat

After the third transmission is read back, the FDC will cause the observer to authenticate using challenge and reply authentication, if there is no type of secure speech used in voice radio traffic.

INSTRUCTOR NOTE: Explain abbreviating the words as much as possible in the call for fire, and while writing CFFs on board ask the students to explain what the observer is asking for in the mission. Place a call for fire on the board explaining and asking for questions on the call for fire pertaining to the six elements of the call for fire.

W24 de W35 ADJUST FIRE, OVER.
GRID 598 354, OVER.
T-82 TANK IN DITCH, ICM I/E, OVER.

Upon receipt of this call for fire in the FDC, the entire section would now have to work together rapidly to streamline the information to the howitzer sections so they could fire onto the target. Each member in the FDC has his own responsibility toward getting information to one central member who will compile all pertinent information and get fire commands to the line of metal. This member is the computer and acts as a **HUB** or center of the operations of the FDC.

INSTRUCTOR NOTE: Show slide of the HUB and explain in detail how each member of the FDC plays an important role in determining data in order to process the mission in a orderly and timely manner.

The call for fire comes from the observer to the FDC normally by means of a FM radio, which we can see portrayed in the Gunnery Team. All members hear this request for fire and respond to it doing their part in getting mission data.

The FDO decides on how to attack the target.
The computer alerts guns that a mission is being processed.
The HCO determines chart data.
The VCO determines altitude and site.
The RTO acknowledges the CFF, composes and sends a MTO.
The CHIEF CMPTR is supervising all operations in the FDC.

The computer is responsible for maintaining a record of the data that is received and determined by the fire direction center. So as to provide a complete and chronologically correct document the DA form 4504 is used.

INSTRUCTOR NOTE: Introduce the Record of fire and each major part explaining that they each contains certain information, and that the block is left blank if it does not pertain to what the observer has sent in his call for fire or if we do not need it for that particular mission. Explain being it is a new form to them it will be covered lock step the first time, but that certain parts are blocked from others and it is important to understand what each portion of the record of fire represents at this time.

Using the pointer follow around the borders of the sections of the record of fire identifying what would be in the general area. Point out the shaded portions explaining that if information is placed in these portions it will definitely be sent to the guns and without it they will not be able to fire the proper data needed to attack the target.

ELO(1) Prepare a record of fire 061-280-1124

The RTO will receive the CFF and record it and announces "**FIRE MISSION**" to the FDC. The computer will record all information from the call for fire in the call for fire block of the record of fire.

(A) From the call for fire, the observer's identification goes in the line labeled Observer

(B) The method of target location lines are used for the appropriate method which was called.

INSTRUCTOR NOTE: Explain that there may not be a U/D correction and refer back to the CFF where the observer only sends it if over 35 meters and to the nearest 5 meters. At this time also explain that the L/R and +/- corrections could only be one or the other and there may be only a L/R and or only a +/- correction from the observer., depending on where the target is from the point he is shifting the target location from.

The Computer will announce "**FIRE MISSION**" to the howitzer sections at this time to give them time to get ready for the firing data to be sent to them. The means used to talk to the line of metal from the fire direction center is normally a wire system run from all pieces and from the FDC to a central location.

INSTRUCTOR NOTE: Transition by telling students what has to happen next and then explain that upon receiving a call for fire, the fire direction officer (FDO) must rapidly analyze the target description and location and make a decision on how to attack the target.

Upon receiving a call for fire, the FDO must make two decisions. First, the FDO must decide if he will attack the target. If the target is to be attacked, the FDO must decide how to attack the target. There is no substitute for the FDO's judgement. However the FDO should consider the following items:

TARGET ATTACK CONSIDERATIONS

a. **Location of the Target** The FDO must check the location relative to friendly forces, fire support coordinating measures, and zones of responsibility. Target location accuracy must also be considered. The range to the target will effect the choice of unit(s) to fire and charge. The terrain around the target may influence ammunition selection and type of trajectory. High intermediate crests may require selection of a lower charge or high-angle fire.

b. **Nature of the Target** The size and type of target (for example, troops, vehicles, hard, soft, and so on) will also effect the following:

* Number of units to fire.
* Type of sheaf.
* Selection of ammunition.
* Number of rounds in effect.
* Priority.
* Whether surprise fire is possible (for example, TOT).

c. **Ammunition Available** The FDO must consider the amount and type of ammunition available and the controlled supply rate (CSR).

d. **Units Available** The number of units available will not only effect which units will be used, but also the type of attack. Sweep and/or zone fire or other techniques may be needed to cover large targets when enough units are not available.

e. **Commander's Guidance or Standing Operating Procedures** Restrictions on ammunition, the operations order, and SOP's may govern the selection of units and ammunition, target priority, and method of attack.

f. **Call for Fire** The FDO must consider the observer's request carefully since he is observing the target and talks directly to the maneuver commander. The observer's request should be honored when possible.

G. **Munitions Effects** The FDO may use the Joint Munitions Effectiveness Manual (JMEM) to determine the type munitions and volume of fire to be delivered. The FDO will rely most often on the Graphical Munitions Effectiveness Table (GMET), attack guidance matrixes, commander's guidance, and/or experience.

H. **Availability of Corrections** The availability of corrections to firing data for nonstandard conditions is a guiding factor in the choice of charge and munitions, since it directly affects accuracy.

I. **Enemy Target Acquisition Capability** Knowledge of the current enemy counter battery radar and sound-ranging capabilities allows the FDO to attack the target in a manner most likely to avoid detection of the unit's location.

This decision is announced in a set format to provide instructions to the FDC. This set format is the fire order. The fire order contains all the necessary directions to the FDC for the attack of the target. Brevity is important, understandability is crucial.

THE FIRE ORDER.

FIRE ORDER ELEMENTS	
ELEMENT	FIRE ORDER
1. UNIT TO FIRE	
2. ADJUSTING ELEMENT/ MOF of ADJUSTING ELEMENT PROJ in adj AMMO LOT & CHG in adj FUZE in adj	
3. BASIS FOR CORRECTION	
4. DISTRIBUTION	
5. SPECIAL INSTRUCTIONS	
6. METHOD of FIRE IN EFFECT	
7. PROJECTILE I/E	
8. AMMO LOT & CHARGE I/E	
9. FUZE I/E	
10.TARGET NUMBER	

FIRE ORDER ELEMENTS

1. **UNIT TO FIRE** is the unit that the FDO desires to fire in effect. In an adjust fire mission the unit to fire will be those pieces that follow the mission. The possible entries for UNIT TO FIRE are:

BN

BTRY

PLT

LEFT

CENTER

RIGHT

ANY GUN NUMBER OR COMBINATION OF NUMBERS

INSTRUCTOR NOTE: Identify that the learning of the platoon concept is what we are concentrating on and that PLT is the element most commonly used, while placing it as the first entry.

2. **ADJUSTING ELEMENT/METHOD OF FIRE OF THE ADJUSTING ELEMENT**

A. **Adjusting Element** indicates the piece(s) that will conduct the adjustment if an adjust fire mission and the number of rounds to be fired per tube for each adjustment. Normally, the base piece is selected and will fire one round in adjustment. The possible entries for adjusting element are:

ANY BATTERY (BN MISSIONS)

PLT

LEFT

CENTER

RIGHT

ANY GUN NUMBER OR COMBINATION OF NUMBERS

INSTRUCTOR NOTE: Indicate that a center piece is used to get the sheaf over the target as much as possible, but another flank piece could adjust if called upon to do so if more than one mission was called to the fire direction center (simo mission). Place #3 1 round in the demo and then explain the adjusting information of different shell fuzes, etc.

In an adjust fire mission it may be necessary to adjust with a projectile other than HE. Should such a case arise, the projectile, lot and fuze to be fired in adjustment will be addressed by the FDO as part of the method of fire of the adjusting element. The possible entries for METHOD OF FIRE OF THE ADJUSTING ELEMENT are:

ANY NUMBER OF ROUNDS, USUALLY 1 ROUND.

PROJECTILE - if other than HE and differing from FFE

LOT - if other than HE and differing from FFE

FUZE - if other than HE and differing from FFE.

INSTRUCTOR NOTE: After explaining this portion of fire order give an example of an illumination mission to reinforce the adjusting shell being announced in this part of the fire order. (Do not make an entry in the this though because a adjust fire mission with HE is going to be used as seen later in the EFFECTS.

3. **Basis for Corrections** is how the FDO indicates the method that will be used to compute firing data for the mission. The possible entries for basis for corrections are TFT, GFT, and MET+ VE. Normally, the fastest method is designated.

INSTRUCTOR NOTE: Identify by questioning the students on what they have already learned and the equipment they have to work with, explaining that the GFT would in a mission like this be what was used because it is faster than getting data out of the tabular firing tables. Place GFT in the basis for correction block of demo fire order.

4. **Distribution** is the desired pattern of bursts on or around the target. It is directly related to how the howitzers have been set up upon occupation of the position from which they are going to fire. The FDO will select one of the following; PARALLEL, CONVERGED, OPEN, SPECIAL, or RANGE and/or LATERAL SPREAD.

INSTRUCTOR NOTE: After explaining distribution relation to how the howitzers are set in formation, identify that the observer has asked for parallel sheaf in his call for fire referring back to the part 2 demo of the call for fire demo's. Explain the fire direction officer would be concurring if he said nothing here for distribution and he would in effect be thus ordering the parallel sheaf be fired. Place parallel in the demo fire order.

5. **Special Instructions** provides a place for the FDO to control time of opening fire and special methods of attack. The possible entries are:

WHEN READY (WR) is **"NOT"** a special instruction. It is the standard time of opening the time of fire unless a special instruction is imposed. This indicates that the howitzers may fire at the section chief's command.

AT MY COMMAND (AMC) is a restrictive command that allows the FDO to control the time of firing from the FDC.

BY PIECE, AT MY COMMAND (BPAMC) may also be used to control the firing of the unit at the FDO's discretion by firing each piece separately.

BY ROUND, AT MY COMMAND (BRAMC) is a restrictive command that allows the FDO to control the time of firing of a group of rounds by volley and will only pertain to the FFE stage.

BY PIECE, BY ROUND, AT MY COMMAND (BPBRAMC) is a restrictive command which combines both BY PIECE and BY ROUND with AT MY COMMAND control.

TIME ON TARGET (TOT) allows the FDO to control the time of firing by indicating the time the rounds will impact at the target. This method will be most frequently used to mass the fires of different units. The time of impact will be announced after TOT.

RIGHT (or LEFT) BY PIECE AT (INTERVAL) is a restrictive command which allows the observer to examine the impacts and determine pieces that are placing rounds outside the sheaf.

AZIMUTH may be included in the fire order when the FDO examines the plot of the target and finds that the pieces must shift trails.

DO NOT LOAD (DNL) allows the FDO to keep the howitzer tubes clear. Used primarily when a period of time elapses before the firing of the mission and thus allows other missions to be fired as necessary.

CANCEL DO NOT LOAD (CDNL) supplementary command of DNL, that is used to allow the guns to load if commanded DNL.

CANCEL TERRAIN GUN POSITION CORRECTIONS (CTGPC) is announced by the FDO when he desires to cause the guns to NOT apply the corrections previously announced to them and carried on the gunner's aid.

PRIMARY, LEFT, RIGHT SECTOR is announced by the FDO to instruct the FDC personnel that TGPCs are changed to the sector indicated. The change to the corrections of another sector will follow a shift in direction of fire.

HIGH ANGLE (HA) indicates the target will be engaged with high angle fire.

SWEEP and/or ZONE provides a method for the attack of large targets, announced as sweep and/or zone. The FDC chief or the computer will determine the number of mils or the number of deflections or quadrants, based on the target size and the FDO's distribution.

USE GUNNERS QUADRANT (UGQ) is announced when firing a registration, destruction mission, or danger close mission, to get accuracy to the nearest tenth of a mil in quadrant elevation.

INSTRUCTOR NOTE: The special instructions are never all used simultaneously but more than one may be issued to the fire direction center.

6. **METHOD OF FIRE FOR EFFECT** indicates the number of rounds to be fired in the fire for effect. It will **ALWAYS** be announced by the FDO.

INSTRUCTOR NOTE: Stress that this is asked for by the observer but unique to all other parts of the fire order, this part always is said by the fire direction officer for the fire for effect portion of a mission, even if he only wants to use one round. Place 3 rounds in the block for the method of fire for effect.

7. **PROJECTILE** indicates the projectile that is to be fired in the fire for effect.

INSTRUCTOR NOTE: The projectile placed in this block is most commonly seen when there is a mission with a shell other than high explosive to be shot in effect. Explain that after the FDO addressed the target attack considerations he has decided to fire shell HE. Place HE in the block for projectile on the demo fire order.

8. **AMMO LOT and CHARGE IN EFFECT** indicates the lot and charge that is to be fired in fire for effect phase.

INSTRUCTOR NOTE: Explain how there may be more than one lot of high explosive ammo that the unit could fire and that it would be necessary to tell the FDC which lot to use. Give an example of having 2 lots high explosive on the line of metal. Identify that you have a GFT setting for lot AG and the FDO decides there would certainly be better accuracy using the registered lot. Place Lot AG in the block and identify that it also states what charge will be used. Explain charge 4 to be sufficient to engage the targets from your position and add to the block for ammo lot & charge.

9. **FUZE in EFFECT** indicates the fuze that is to be fired in the fire for effect phase. When shell HE is to be fired in effect only the fuze need be announced. When firing other

types of rounds only the projectile is announced except when white phosphorus (WP) or time (TI) is desired.

INSTRUCTOR NOTE: Identify how the shell can be changed or determined based off of the announcement of the fuze alone. Reinforce the observer's request and explain the changes being made by the FDO as well as his agreement when making his entire fire order. Place Q I/E as the FDO's decision of the fuze to use in the block for fuze.

10. **TARGET NUMBER** clearly identifies (or serializes the mission). Adhering to the use of the target number and prefacing all data and communications with this number allows the FDC to process multiple missions without the possibility of confusion within the Gunnery Team.

INSTRUCTOR NOTE: Explain that the target block has been assigned by NATO for each element of the major commands and we use these numbers as a means of getting numbers to assign to the missions processed through the FDC. Place GD1001 as the number assigned to this mission in the block for target.

FIRE ORDER	
ELEMENT	FIRE ORDER SOP
1. UNIT TO FIRE	PLT
2. ADJUSTING ELEMENT/ MOF of ADJUSTING ELEMENT PROJ in adj AMMO LOT & CHG in adj FUZE in adj	#3 1RD
3. BASIS FOR CORRECTION	GFT
4. DISTRIBUTION	PARALLEL
5. SPECIAL INSTRUCTIONS	
6. METHOD of FIRE IN EFFECT	3 RDS
7. PROJECTILE i/e	HE
8. AMMO LOT & CHARGE i/e	LOT AG, CHG 4
9. FUZE i/e	QUICK
10.TARGET NUMBER	GD 1001

INSTRUCTOR NOTE: Explain that the entire fire order though long does indeed explain explicitly how the FDC will attack the target, but would certainly not fit in the box on the record of fire very well, or take just moments to jot down for the computer who is responsible to maintain a record of this, giving a need to have some of it understood as always standard and not announced unless changed from one mission to the next.

The FDO is responsible for assigning fire order standards. The fire order standards allow the FDO to shorten the fire order by announcing only those elements that differ from the assigned standards. The FDO must be guided by common sense, the state of training of the FDC and the situation. The fire order elements may be standardized using specific items such as "PLT" for the unit to fire. Whenever possible the term "OBSERVER/FDO SELECT" has been used. This standard allows the FDO to concur with the observer's request (as stated in the call for fire) by remaining silent. For instance, the observer requests "ICM i/e". The standard for projectile is "OBSERVER/ FDO SELECT". By making no announcement the FDO indicates his decision to fire ICM i/e.

FIRE ORDER STANDARDS	
ELEMENT	FIRE ORDER SOP
1. UNIT TO FIRE	PLT
2. ADJUSTING ELEMENT/ MOF of ADJUSTING ELEMENT PROJ in adj AMMO LOT & CHG in adj FUZE in adj	#3 1RD
3. BASIS FOR CORRECTION	FASTEST METHOD
4. DISTRIBUTION	OBSERVER/FDO SELECT
5. SPECIAL INSTRUCTIONS	OBSERVER/FDO SELECT
6. METHOD of FIRE IN EFFECT	FDO ANNOUNCE
7. PROJECTILE i/e	OBSERVER/FDO SELECT
8. AMMO LOT & CHARGE i/e	LOT AG, CHG 4
9. FUZE i/e	OBSERVER/FDO SELECT
10.TARGET NUMBER	NEXT AVAILABLE

INSTRUCTOR NOTE: explain the standard items telling why each can or can't be standard in the fire direction center.

ISSUING THE FIRE ORDER.

Upon arriving at the decision to attack the target the FDO will compose his fire order by filling in the "blanks" for each element of the fire order format. At worst case (using no standardization of elements) the FDO could make an announcement for each element. The FDO's next step is to compare his "fill in the blanks" fire order with the standards established in the FDC. Those elements that are the same as the established standards are not announced. The remainder of the fire order is announced.

ELO(3) Explain an area fire mission 061-280-5001

FIRE ORDER AMC, 3rds, Qi/e

The computer would record only the elements announced from the fire direction officer onto the record of fire in the fire order block.

MESSAGE TO OBSERVER

The call for fire is a request for fire. The fire order is announced in the FDC to inform the FDC of the FDO/CHIEF CMPTR's decision of how the target will be attacked. The message to observer is transmitted from the FDC to the observer to inform him of the decision. The MTO must be transmitted in a timely fashion as it advises the observer of what to expect and influences how he will conduct the mission.

INSTRUCTOR NOTE: Drop demo of MTO and identify its elements as a whole, then explain each separately and give the students participation in selecting what the call for fire and fire order being used will have for a message to observer.

Elements of the Message to Observer

1. **Units to Fire** The first element is the unit(s) that will fire the mission. It is always announced. If a battalion is firing in effect with one battery or platoon adjusting, the MTO will designate the FFE unit (battalion or battery) and the adjusting unit (battery or Platoon). The units to fire are identified by their radio call signs, using long, short call signs, or the first letter of the short call sign.

3. **Changes or Additions to the CFF** informs the observer of any changes or additions to the CFF. Usually this includes the shell/fuze if it differs from that requested. This may include such changes as trajectory high angle.

4. **Number of rounds** is the number of volleys in the fire for effect phase. The number of rounds to be fired in effect is **ALWAYS** announced.

5. **Target Number** identifies the target mission by number that will be used to avoid confusion if multiple missions or more than one observer operates on the net.

6. **Additional information** is provided, as it becomes available:

a. **Probable Error in Range** is announced when equal to or greater than 38 in area fire and 25 in precision fire. The actual value is not announced.

b. **Angle T** is sent to the observer when it is equal to or greater than 500 mils or if the observer request it. It is announced to the nearest 100 mils.

NOTE TO INSTRUCTOR: Only PEr, Angle-T, and Time of Flight will be on the demo for MTO.

c. **Pulse Repetition Frequency Code** (PRF) code for a copperhead mission is transmitted in voice operations.

d. **Time of Flight** (TOF) is announced to the nearest whole second. It is announced to observers when targets are engaged with Copperhead, when moving targets are engaged, when conducting high angle missions, when using an aerial observer, or when requested by the observer.

e. **Splash** informs the observer that the round(s) will impact in 5 minutes. It must be sent to aerial observers and during high-angle fire missions. It can also be sent when the observer requests it.

f. **Shot and Rounds Complete. Shot** is announced to the observer to report when a round has been fired. **Rounds complete** is announced to the observer when all rounds for a particular mission have been fired.

During an adjust-fire mission **SHOT** is announced after each round. Once the FFE phase is initiated, **SHOT** is announced only on the initial round. Once all rounds have been fired, **Rounds Complete** is announced to the observer. For an FFE mission, **SHOT** is announced only on the initial round; once all rounds have been fired, **Rounds Complet**e is announced to the observer.

INSTRUCTOR NOTE: EXPLAIN THAT THIS MESSAGE TO OBSERVER IS NORMALLY SUPPLEMENTED WITH THE ADDITIONAL INFORMATION AS IT BECOMES AVAILABLE TO THE RADIO TELEPHONE OPERATOR (RTO).

The computer will record the message to observer in the MTO block of the record of fire.

MTO N, Qi/e, 3rds, TGT NO GD 1001

ELO(4) Process an area fire mission

The computer would request his chart data needed to determine basic firing data from the horizontal control operator and records it on the record of fire in the chart range and chart deflection boxes.

INSTRUCTOR NOTE: Explain that the computer needs the chart data to get his basic firing data and that from the basic firing data the fire commands are determined to send to the howitzer sections. **NOTE** that you will reinforce the 3-step method to determine the firing data needed, **NOT** in the order of the ROF blocks.

FIRE COMMANDS.

Fire commands provide the link between the FDC and the guns. All information necessary to make the guns load and fire a round are contained in the fire commands. The fire commands are ordered to assist the gun sections in following these commands while preparing the weapon for firing. Fire commands fall into two categories:

Initial fire commands are those commands issued by the FDC to fire the first round or volley of a mission. The initial fire commands contain all information to allow the gun(s) to fire the first round(s) of the mission and additional information to allow preparation of ammunition for the fire for effect in adjust fire missions.

Subsequent fire commands are those issued by the FDC to fire additional rounds or volleys in a mission. The subsequent fire commands contain only that information that differs from that last announced.

FIRE COMMANDS	
WARNING ORDER	
PIECES TO FOLLOW/ PIECES TO FIRE/ MOF	
SPECIAL INSTRUCTIONS	
PROJECTILE	
LOT	
CHARGE	
FUZE/FUZE SETTING	
DEFLECTION	
QUADRANT ELEVATION	
METHOD OF FFE	

INSTRUCTOR NOTE: Using the slide of the elements of fire commands, explain each for initial fire commands filling the blanks until all initial commands have been announced.

ELEMENTS OF THE FIRE COMMANDS.

1. **WARNING ORDER** is always FIRE MISSION! And is always announced in the initial fire commands and not in the subsequent fire commands. The warning order alerts the gun sections to take their places at the piece and to standby for the mission.

2. **PIECES TO FOLLOW/ PIECES TO FIRE/ METHOD OF FIRE** is a three part command that indicates who is involved in the mission and who will fire.

a. **PIECES TO FOLLOW** are those pieces that will follow the mission (lay on the target during adjustment). These are the guns designated to participate in the FFE phase. PIECES TO FOLLOW are announced followed by the word "ADJUST". As in either Battery ADJ or PLT ADJ.

b. **PIECES TO FIRE** indicate the gun or guns that will fire the initial firing commands. PIECES TO FIRE is derived from the UNIT TO FIRE in the fire order, for FFE missions and ADJUSTING ELEMENT for adjust fire missions.

c. **METHOD OF FIRE** is the number of rounds to be fired by the PIECES TO FIRE. Indicated in the fire order as ADJ ELE/ MOF in AF and METHOD OF FIRE in FFE.

3. **SPECIAL INSTRUCTIONS** are additional commands used to control the time of opening fire or special methods of fire.

INSTRUCTOR NOTE: Show slide of the special instructions, displaying one element at a time so as to not have students getting ahead of each element as it is being discussed. A lot of these will already have covered in the special instructions from the Fire Order explanation.

WHEN READY (WR) although WR is not a special instruction. It indicates that the guns may fire at the section chief's command.

AT MY COMMAND (AMC) is a restrictive command that allows the FDO to control the time of firing from the FDC. When announced in the special instructions of the fire commands, AMC will indicate that each round in the adjustment stage and the first volley of the fire for effect will be at the FDC's command. To fire AMC the FDC could announce **PLATOON STANDBY, FIRE** or **CANCEL AT MY COMMAND, QUADRANT 1111**.

BY ROUND, AT MY COMMAND (BRAMC) is a restrictive command that allows the FDC to control the time of firing of a group of rounds by volley. BRAMC will pertain only to the FFE stage of the mission.

RIGHT (LEFT), BY PIECE AT (INTERVAL) is a restrictive instruction which the can cause the pieces to fire at an announced interval, beginning at either end of the gun line. This is used to allow the observer to examine the impacts and determine pieces that are placing rounds outside the sheaf.

BY PIECE, AT MY COMMAND may also be used to control the firing of the unit by gun at the FDC's discretion.

AZIMUTH is included in the fire commands when the FDC finds that the pieces must shift trails. The command ":AZIMUTH (4 DIGIT VALUE)" will be transmitted as a special instruction to the guns.

DO NOT LOAD (DNL) allows the FDO to have the guns lay on a target but leave the tubes clear.

This command may be used when a period of time elapses before the firing of the mission and thus allows other missions to be fired as necessary.

CANCEL DO NOT LOAD (target number) (CDNL) is the supplementary command that is used to allow the guns to load, when followed with a quadrant. ZONE/SWEEP provides a method for the attack of large targets. The FDC will announce SWEEP, -- MILS-- DEFLECTIONS AND OR ZONE -- MILS-- QUADRANTS.

CANCEL TERRAIN GUN POSITION CORRECTIONS (CTGPC) is announced by the FDC to cause the guns to NOT apply the corrections previously announced to them and carried on the gunner's aid. CTGPC apply only to the mission in which the command is announced.

USE GUNNERS QUADRANT is announced when firing missions that more precise quadrant elevations are needed. (DESTRUCTION).

PRIMARY, LEFT, RIGHT SECTOR allows the FDC to instruct that TGPC are to be changed to those indicated. The sector corrections will follow a shift in direction of fire (shift of trails). This command will be transmitted to the guns as a special instruction and will remain in effect until the pieces are directed to shift sectors.

HIGH ANGLE (HA) indicates the target will be engaged with high angle fire. This is normally 800 mils or greater.

SPECIAL CORRECTIONS is announced to alert the pieces that more than one set of firing data will be announced for the mission.

INSTRUCTOR NOTE: Place AMC in the demo as the standard to use for this mission. Explain that W/R is understood by the sections on the line of metal when no restrictive commands are given.

4. **PROJECTILE** is the shell to be used in the fire mission.

INSTRUCTOR NOTE: Indicate to students that it is the projectile but the command to the howitzer sections would be SHELL (TYPE).

5. **AMMUNITION LOT** is the projectile/propellant lot to be fired.

INSTRUCTOR NOTE: Indicate the importance of giving the projectile and propellant lots to the howitzer sections so they do indeed fire what has been ordered in the fire order.

6. **CHARGE** is the charge to be fired and is ALWAYS announced in initial fire commands.

INSTRUCTOR NOTE: The type of propellant (4 GB) is not announced after the charge since the propellant lot indicates the propellant type.

7. **FUZE/FUZE SETTING** is the fuze to fire and the fuze setting.

INSTRUCTOR NOTE: Indicate that when firing the quick (PD) fuze there is no fuze setting given. The delay setting of this fuze would be announced as fuze DELAY rather than QUICK.

8. **DEFLECTION** is the deflection to fire.

INSTRUCTOR NOTE: Point out to students that deflection changes as we change aim points.

9. **QUADRANT** is the quadrant elevation to fire, (Ele + Site).

INSTRUCTOR NOTE: Point out to students that Quadrant changes as we change aim points.

10. **METHOD OF FIRE IN EFFECT** is the number and type of rounds to be fired in FFE phase. If more than one lot is available, the lot will be announced. This allows the guns to prepare ammunition for the FFE.

STANDARDIZATION OF FIRE COMMANDS

Fire commands may be standardized. The standards are established by the FDO/CHIEF CMPTR and transmitted to the guns on occupation. The standards remain in effect until changed by the FDC.

1. **WARNING ORDER** is always announced so you will not make it a standard. It will only be announced in the Initial Fire Commands never in the Subsequent Fire Commands.

2. **PIECES TO FOLLOW, PIECES TO FIRE, METHOD OF FIRE** may be standardized. This is most frequently done in manual gunnery because the same piece conducts all adjustment. When any of these change you must announce them in the Subsequent Fire Commands.

3. **SPECIAL INSTRUCTIONS** may be standardized when applicable. In Subsequent Fire Commands only when changed.

4. **PROJECTILE** is usually standardized as HE as this is the usual adjusting shell and most frequently fired. In Subsequent Fire Commands only when changed.

5. **AMMUNITION LOT** is the registered lot or the lot most frequently fired. Based on the charge selected in the fire order standard, a lot is selected for the fire command standards and can be changed during the mission in the Subsequent Fire Commands.

6. **CHARGE** is always announced in the Initial Fire Commands. It can be changed during the mission in the Subsequent Fire Commands.

7. **FUZE** is usually standardized as Q as it is the most frequent adjusting fuze and it can be changed during the mission in the Subsequent Fire Commands.

8. **FUZE SETTING** can be standardized only when applicable. It is also announced when changed in the Subsequent Fire Commands.

9. **DEFLECTION** is always announced in the Initial Fire Commands and in the Subsequent Fire Commands when changed.

10. **QUADRANT** Is always announced in the Initial Fire Commands and the Subsequent Fire Commands.

11. **METHOD OF FIRE** can be standardized in the Initial Fire Commands and announced in the Subsequent Fire Commands when changed.

INSTRUCTOR NOTE: Drop blank fire commands demo and place each element of the fire commands in this demo explaining why they can or cannot be standardized emphasizing the need to be able to streamline this information to the howitzers, CONTINUALLY STRESSING the need to send this data in a prescribed sequence to the howitzer sections.

INSTRUCTOR NOTE: At this point the GFT setting will be needed to be placed on the GFT to get the deflection to fire because drift and GFT DF CORR are needed to add and apply to the chart deflection. Students apply:

UNIT 1/A
C harge 4
A mmo lot AG
R ange 4640
E levation 282
T ime 16.0

TOT DF CORR: L4
GFT DF CORR: R1

FIRE COMMAND STANDARDS

The computer must record the fire commands onto the record of fire in the appropriate spots to maintain a complete record of the mission.

INSTRUCTOR NOTE: Point out the blocks for initial chart data and add this DATA TO THE DEMO record of fire; the elevation block will be identified and the students will determine the elevation and then place this elevation in the elevation box next to the CHT DF.

ELE 283

The drift and the GFT DF CORR derive a deflection correction (DF CORR), that when applied to the chart deflection that corrects the direction for non-standard conditions.

INSTRUCTOR NOTE: Have students determine a drift corresponding to the elevation determined reminding them that drift is a function of elevation and not read from under the MHL setting over the RG but rather under the MHL over the elevation they determined and recorded on the ROF.

DRIFT L6

The drift is now applied to the GFT DF CORR: R1. The sum of this algebraic addition is a L5 for DF CORR and then will be added to the chart deflection to get the deflection to fire.

GFT DF CORR R1
+ DRIFT L6
DF CORR L5

Once chart deflection and the deflection correction are added the deflection to fire is determined.

DF CORR L5
CHT DF 3104
DF FIRED 3109.

INSTRUCTOR NOTE: Show the students at this point how to record the computation of DF CORRECTION on the ROF in the upper computation block.

The data is only determined up in the computation box for the deflection correction. Once determined it is carried down so that it can be added to the CHT DF.

INSTRUCTOR NOTE: Explain that the site will need to be determined to add to the elevation to get the quadrant and lock step how to determine VI for this TGT location and how to record it in the upper computation block.

The Obs' correction is then applied to the altitude of TGT GD8063 (363) and the Tgt alt is determined. The observer has identified that down 40 meters from the target he is shifting from is the altitude of the target that he is requesting we fire upon. By taking 40 meters away from AC8063's altitude of 363, we get the target altitude of 323 meters.

The platoon's altitude is now algebraically subtracted from the TGT's altitude to determine the vertical interval (VI),

GD 8063 ALT	**363**
(D)	**- 40**
TGT ALT	**323**
PLT ALT	**296**
VI	**+ 27**

With vertical interval determined we can use the site range scales of the GST to determine the site.

SITE +6

INSTRUCTOR NOTE: Show students where site block is and have them record it.

With site determined we simply add it algebraically to elevation to get the quadrant elevation (QE).

SI	**+6**
ELE	**283**
QE	**289**

INSTRUCTOR NOTE: Show students where QE block is and have them record it.

The computer will send this information in sequence to the howitzer sections with one of the pieces (normally the adjusting piece) reading the fire commands back to the computer.

INSTRUCTOR NOTE: Point out the heavily bordered lines on the record of fire showing the outer edges of the initial fire commands block. Also, explain again that the shaded areas must be sent to the guns when filled in, unless they're in parentheses.

The standards will be used for all the missions we will be doing in the operations of the FDC. The initial fire commands are sent like reading a book. This facilitates the howitzer sections because they will know what will be coming next with us using a standard prescribed sequence in sending our commands.

INSTRUCTOR NOTE: Explain that in the initial commands we can, as a computer, send down some of the commands before we have to have chart data. Start a sequence of announcing commands to the guns through charge.

The computer circles or checks the FM block and announces this and waits for #3 (The gun ordered to read back all fire commands when the platoon is in the same mission, unless a piece or pieces have been given separate data. They would then read back their own data.) to acknowledge.

After the gun reads back 'Fire Mission,' the computer sends the next command in sequence, platoon adjust, (The special instruction of At My Command may be sent with platoon adjust), and waits for read back again. After read back he sends charge 4. Because shell and lot are standardized, they need not be sent, unless they differ from standard, then they are always sent.

SPECIAL METHODS OF FIRE

INSTRUCTOR NOTE: EXPLAIN AT THIS TIME THAT THE FIRE COMMANDS THEY HAVE SEEN SO FAR ARE IMPORTANT AND SUPPLEMENTED WITH OTHERS IN CERTAIN CASES. SHOWING SLIDE EXPLAIN EACH OF THE SPECIAL METHODS OF FIRE THAT MAY BE USED WHEN NEEDED.

1. **CHECK FIRING** can be announced by anyone and will cause firing to cease immediately. This command is used when all data has been sent to the howitzers and an item must be corrected. When the command is announced the FDO\CHIEF CMPTR must take immediate action to determine and announce the reason for the command.

2. **CEASE LOADING** allows the firing platoon to fired rounds that have been loaded, but no additional rounds may be loaded. This applies to multiple round missions.

3. **END OF MISSION** means that the fire mission has been terminated. The howitzer sections should return to the azimuth of lay or to any predetermined priority or final protective fires.

4. **PLANNED OR PRIORITY TARGETS** The platoon may be assigned planned targets for which current firing data is maintained.

In such cases, SOP usually designates a command or a prearranged signal to fire on the priority target, bypassing the normal sequence of fire commands with a previously arranged method of fire.

5. **CONTINUOUS FIRE AND FIRE AT WILL** is announced when it desired that the howitzer crew continue to fire until the command Check Fire or Cease Loading is announced. Fire at will is use in a direct-fire role, primary for perimeter defense.

6. **CANCEL CHECK FIRING** will be announced once the situation requiring Check Firing has been corrected.

INSTRUCTOR NOTE: Generate a scenario where the fire command for deflection had been announced to the howitzers correctly, but the command when read back from gun #3 was wrong (read a reversed deflection back from the gun to reinforce what you are presenting).

The howitzer sections may from time to time read back wrong data or they may request that the FDC say again (repeats) a fire command back to them if they do not understand it.

REPETITION AND CORRECTION OF FIRE COMMANDS

If the command was misunderstood when read to the howitzer sections, the read back piece or any piece that did not understand the command, requests the command again as a question to the FDC.

#4 DID NOT HEAR THE DEFLECTION FROM FDC. HE STATES THE COMMAND THAT HE NEEDS ON HIS PIECE AND HIS GUN #.

FOR EXAMPLE, "DEFLECTION NUMBER 4?"

THE COMPUTER THEN READS BACK TO THAT GUN THIS COMMAND**.**

"#4 THE COMMAND WAS DEFLECTION AND THE VALUE."

INSTRUCTOR NOTE: Explain also that the FDC may be the one to have made a mistake in sending the fire commands to the howitzer sections. Generate a scenario where the computer makes a mistake on the command and needs to go back to it and repeat it correctly.

Let us assume that the computer has accidentally sent to the howitzers a command for deflection and realizes that it has been sent was incorrect (BAD DATA). The computer must go back and correct this fire command to that he has sent.

The repetition or correction of fire commands can be originated from either the howitzer sections or the FDC. Under periods of intense operations there may be a mistake made on both parts, the FDC sending commands and/or the howitzer sections hearing or reading back the commands to the FDC incorrectly. This is usually the case in the numbers for time, deflection, or quadrant, when the phonetic alphabet is not used correctly.

If the command was sent to the howitzers but QE has not been sent , the computer simply goes back to where the mistake was made and corrects it by stating:

CORRECTION, THE COMMAND THAT IS WRONG, AND THE CORRECT COMMAND.

FOR EXAMPLE: "CORRECTION DEFLECTION AND WHATEVER THE DEFLECTION WAS SUPPOSED TO HAVE BEEN."

After the correction is made, then the computer continues sending the rest of the fire commands.

IF QUADRANT HAS BEEN SENT THE COMPUTER RESPONDS WITH:

CHECK FIRING! (BECAUSE QUADRANT GIVES PERMISSION TO LOAD AND FIRE UNLESS OTHERWISE RESTRICTED BY A SPECIAL INSTRUCTION).

AFTER AN ACKNOWLEDGE OF THE CHECK FIRING IS RECEIVED FROM THE HOWITZER SECTIONS THE COMPUTER RESPONDS WITH:

CANCEL CHECK FIRING FOLLOWED BY THE CORRECTED COMMAND AND ALL SUBSEQUENT ELEMENTS.

The method of fire for effect is usually given next to assist in the howitzer sections having enough time to break out ammunition in the missions, which get attacked differently for effects. This must be announced prior to the fire for effect phase of the mission, in adjust missions and is never announced in fire for effect missions.

3 RDS IN EFF

INSTRUCTOR NOTE: EXPLAIN TO STUDENTS THAT THE HOWITZER SECTIONS MUST INDICATE TO THE FDC THAT THEY HAVE INDEED COMPLIED TO THE COMMANDS SENT TO THEM FROM THE FDC. THEY DO THIS THROUGH WHAT IS CALLED REPORTS.

By sending reports to the FDC we can keep track of the ammunition being fired and are continually updated on status of what is going on at the line of metal.

If ammunition amounts are requested by the fire direction center, it is sent by type and lot from the howitzer section.

FIRING REPORTS SENT BY THE HOWITZER SECTIONS

SHOT: THIS REPORT IS SENT WHEN THE HOWITZER HAS FIRED IN A MISSION.

ROUNDS COMPLETE: THIS REPORT IS SENT WHEN MULTIPLE ROUNDS HAVE ORDERED TO BE FIRED AND THE LAST OF THESE HAS BEEN FIRED.

MISFIRE: THIS REPORT IS SENT WHEN THE HOWITZER SECTION HAS MADE THE FIRST OR SUBSEQUENT ATTEMPTS TO FIRE AND WEAPON DOES NOT

READY: THIS REPORT IS SENT WHEN THE HOWITZER SECTION HAS PREPARED WEAPON FOR FIRING AND IS READY TO FIRE, BUT THE FDC HAS A SPECIAL INSTRUCTION GIVEN NOT TO FIRE WHEN READY.

LAID: THIS REPORT IS GIVEN WHEN HOWITZER HAS HAD ALL DATA PLACED ON IT CORRECTLY WITH NO PROJECTILE IN TUBE, DUE TO A SPECIAL INSTRUCTION FROM THE FDC.

ERRONEOUS DATA FIRED: THIS REPORT IS GIVEN WHEN OTHER DATA THAN WHAT THE FDC HAS ORDERED TO BE FIRED, HAS ACCIDENTALLY BEEN FIRED. IT IS ANNOUNCED WITH GUN NUMBER PRECEDING & NEGLECT

The computer must keep a cumulative count of all the ammunition expenditures that the platoon fires. To do this the computer will start his count by placing the number of rounds in the block identified as Ammo Exp below the quadrant block of the initial fire commands.

AMMO EXP 1RD

INSTRUCTOR NOTE: Point this block out using a pointer to outline the entire block and explain that a cumulative count means that each time rounds are fired from the howitzers the computer annotates this on the record of fire. Ask students how many rounds were fired then place one in the block upon getting the correct response. At this time point out the subsequent ammo exp blocks.

The ammunition is identified depending upon what type of projectile has been fired. If the projectile is High explosive the fuze is cumulated and placed in the type box when it changes to another type of fuze and the count starts back at the amount fired of the new type of fuze. When other than high explosive projectiles are fired the projectile count is cumulated rather than fuzes.

INSTRUCTOR NOTE: Explain that the ammo count is placed in the blocks and not circled until it has been fired from the howitzers. This eliminates the chance of getting a count that is cumulated but for some reason is not fired due to a problem on piece firing, (usually happens when firing for effects). (Announce ready, & shot number 3).

At the announcement of shot from the howitzer section we would circle the round count placed in the expenditure block.

The computer would be going through other procedures while the howitzer section is readying the howitzer. The delta fuze setting is not determined until the first time fuze is fired. We will be using it in another mission later in class and discuss it in detail at that time.

The 100/R would need to be placed in the box identifying 100/R in case it is needed later to move the strike of the round 100 meters laterally or vertically as we have learned this will do for us in Basic Firing Data.

100/R 22

INSTRUCTOR NOTE: Point out the box for 100/R, /R, and 20/R on the record of fire, explaining that the /R is not used unless you want a correction of other than 100/R or 20/R. Then request 100/R and place it in the block. Explain the 20/R and place it in the 20/R block of the ROF.

We normally need the 20/R when we are firing the first time fuze because the data is determined for a graze burst and then corrected for the appropriate height of burst. Time fuzes on the high explosive work best at 20 meters above the ground 20/R is determined for any mission that it may be used eventually in the mission even if we were not to use it.

20/R 4

The record of fire is policed up as much as possible while the ammunition is being fired and the observers corrections are awaited on in the event that the target needs to be adjusted on to get best effects before shooting the entire platoon.

With shift from Knpt and polar missions the HCO will have determined the angle T and announce it to the computer for recording on the record of fire. This is sent to the observer when it is equal to or greater than 500 mils, to aid in his bracketing of the target. The RTO monitors the announcement and sends it when circumstances discussed are met.

ANGLE T (520)500

INSTRUCTORS NOTE: Point out where the angle t is recorded and explain that it is put in parenthesis if not sent or if not announced as an even hundred and then expressed to the nearest hundred outside of the parenthesis to indicate the amount of angle t which has been sent.

The probable error in range is determined using table G of the tabular firing table with the appropriate charge and range to the nearest listed value. This is recorded and sent to the observer for area fire missions when it is equal to or greater than 38 meters.

PER (<38)
(16)

INSTRUCTOR NOTE: Show where it is recorded on the record of fire and explain that the value is placed in as <38 and in parenthesis at their units when not sent, but here it will be required to be looked up and the value listed from in the TFT will be placed under the <38 if indeed it is less than 38. Identify the reason being the majority of the probable errors in range are small with the charges we use in class and if students assume it to always be small they forget how to go get the value and sometimes tend not to even look and only place a <38 in this block all of the time.

The time of flight is determined to the nearest whole second and placed in the time of flight box of the message to observer. It is always sent when firing high angle, when utilizing an aerial observer, and when requested by the observer. If it does not meet any of these requirements then it is placed in parenthesis and not sent but rather just kept as a record. Time of flight is determined from the first elevation.

TOF (17)

INSTRUCTOR NOTE: Point out the TOF block of the on the record of fire and request it from one of the students. When correctly identified place the value in the block, asking another if it requires parenthesis. Add the parenthesis once given the answer yes to above situation.

It must be understood that when we have adjust fire missions there is normally corrections sent by the observer to get closer to the target so we can get our maximum effects from our munitions. These corrections are used similar to the initial fire commands, but there is some exceptions.

SUBSEQUENT FIRE COMMANDS	
WARNING ORDER	NEVER SEND FOR SUBSEQUENT COMMANDS
PIECES TO FOLLOW/ PIECES TO FIRE/ MOF	WHEN CHANGED FROM INITIAL FC WHEN CHANGED WHEN CHANGED
SPECIAL INSTRUCTIONS	WHEN CHANGED
PROJECTILE	WHEN CHANGED
LOT	WHEN CHANGED
CHARGE	WHEN CHANGED
FUZE/FUZE SETTING	WHEN CHANGED
DEFLECTION	WHEN CHANGED
QUADRANT ELEVATION	ALWAYS SENT INITIAL AND SUBSEQUENT
METHOD OF FFE	WHEN CHANGED AND BEFORE FFE

INSTRUCTOR NOTE: Point out the area where subsequent fire commands are determined on the record of fire, explaining each block including the shaded areas purpose to reinforce that if filled in it must be sent to the howitzers.

The deflection correction can be brought down to the subsequent fire commands block and used to correct a new chart deflection from an observer correction for missions which are using low angle fire and the HE family of shells.

Due to the time lost by re-determining the deflection correction on subsequent firing and the accuracy's gained (which are minimal being the target begins to posture and become harder to defeat), with a longer delay between firing each subsequent round we carry the initial DF CORR all the way through the mission.

INSTRUCTOR NOTE: Ask a student what the DF CORR to carry down will be and that the site can be used in subsequent corrections for basically the same reason as the deflection correction (to little improvement in firing data for the amount of time it takes to recompose for subsequent rounds. Once the correct answer is given bring DF CORR down and then the site and place them in the appropriate boxes.

INSTRUCTOR NOTE: Identify the block for observer subsequent corrections explaining each. Then place corrections in while playing the role of the observer as the mission progresses.

The observer sees the impact of the round and decides there needs to be some corrections before we can fire for effect. He sends the corrections to the FDC with lateral corrections first and then range corrections. If there is only one correction then the other was close enough. The deviation corrections are easier for the observer to make because of his binocular reticle pattern. It has no scale for range and the observer must estimate the range bracket.

OBS CORRS R 80 +200

INSTRUCTOR NOTE: Announce the observer corrections having the entire class read the correction back properly, playing the role of the RTO.

The computer would record chart data from the HCO for subsequent corrections in the SUBSEQUENT FIRE COMMANDS block in bottom portion of the record of fire and determine DEFLECTION FIRED AND QUADRANT ELEVATION for each subsequent correction by adding the DF CORR that was carried to the parenthesis down to the next line and would be applied to the subsequent chart deflection which the HCO would determine from the corrections sent to get deflection to fire. The site would be carried down and added to the new elevation to get the quadrant to fire.

HCO ANNOUNCES 1/A RNG 4810, DF 3071

CHT DF	DF CORR	DF FIRED	RNG	HOB CORR	SI	ELE	QE	AMMO EXP
3071	L5	3076	4810		+6	295	301	2

The ammunition would be cumulated from the previous amount because the same shell fuze combination is being fired. Also again the gun would report ready first, because of the AMC special instructions and when commanded by the FDC to fire, then the section would fire the howitzer.

INSTRUCTOR NOTE: Repeat the previous steps for subsequent fire commands until end of mission is received from observer.

OBS CORR -100
HCO ANNOUNCES 1/A RNG 4720, DF 3080
DF FIRED 3085 QE 294 AMMO EXP 3

After fire commands are determined and announced, the howitzer reports ready and is fired.

OBS CORR +50 FFE

HCO ANNOUNCES 1/A RNG 4770, DF 3080

At this point the method of fire has to be changed because the observer has requested FFE in his corrections. There will be no shell or fuze change in this mission, as seen in the fire order. The FDC commands the platoon to fire the 3 HE/Q by announcing platoon three rounds and placing it in the large shaded block of the subsequent fire commands. This command identifies to the platoon that rather than just follow the mission the entire platoon will fire upon the target. The reports will come as a ready from each piece as they get ready and a shot from each piece as they fire, noticing they will give rounds complete because they are firing a total of three rounds each.

PLT 3rds, DF FIRED REMAINS (3085) QE 298 AMMO EXP 15

INSTRUCTOR NOTE: Ask if there are questions here on why the method of fire changed and why the announcement was critical to be sent first, reinforcing by again explaining the commands be sent like reading a book.

The ammunition count at this point changes from 1 round at a time to the additional 12 rounds, which the platoon will fire. The count is added to the rounds that have already been fired because the fuze in the effect part of the mission is the same as the fuze that has been used in the adjustment, quick.

OBS REPORTS END OF MISSION

INSTRUCTOR NOTE: The students at this point should be asked some questions on what they would have done if the fuze had changed for the fire for effect portion. Once they have a good understanding of this continue on with the mission. The students need to understand that the EOM from the observer should give a battle damage assessment. The students make this up when they do their practical exercises. Make reference to what the target is and use something with reference to it. Allow the students to practice a couple when selected on one at a time. Any BDA that is non-realistic should be discouraged.

The guns will need to have the mission ended on them because they do not hear the observer talking. The FDO or CHIEF CMPTR must order the computer to end the mission rather than the computer assuming it is ended.

MF,Sh,Chg,Fz
EOM

The administrative data for the mission must be policed on the record of fire. If the ROF is looked at later there is no question to who shot the mission, when it was shot, and the target number that was used in the mission, normally the next available out of the target block for the unit.

INSTRUCTOR NOTE: Point out the administrative block and show where each pieces of data goes. Start with the unit and call sign and then the date time group. Ask the soldiers what the target number was for the mission and after getting the correct response fill it in.

HE/VT

INSTRUCTOR NOTE: At this time a new mission will be initiated. The students will be required to place a new GFT setting on their GFTs for this mission. Have them erase the old GFT setting and place this GFT setting. Prepare a new record of fire ready for the new mission.

U nit	**1/A**
C harge	**2**
A mmo lot	**AG**
R ange	**3720**
E levation	**434**
T ime	**18.7**
TOT DF CORR	**L7**
GFT DF CORR	**R3**

INSTRUCTOR NOTE: Check the GFT setting of students to ensure correct placement, then place this call for fire on the board. Have the students read back each of the transmissions, while you play role of observer and they (or a selected student), play the role of the RTO.

N81 de N82, AF, POLAR k
DIR 0900, DIS 3600, D 30 k
MISSILE SITE, TI I/E k

INSTRUCTOR NOTE: show again where call for fire goes and explain as you place it on the new record of fire. This method of target location is polar grid and the first mission was a grid.

FIRE ORDER: 2 RDS, CHG 2, VT i/e

INSTRUCTOR NOTE: explain that at this point things happen simultaneously. The HCO determines chart data; the VCO determines site; the RTO determines and sends the message to observer; and the computer determines and announces the initial fire commands. State that you will practice each in steps starting with the sending of the message to observer.

Ask students what the last target number was and refer to the FO standards. Request the next available and place it in the administrative block of record of fire.

MTO N, VTi/e, 2rds, TGT NO GD1002

Announce chart data playing the role of the HCO and place it on the record of fire when students read it back, playing the role of the computer.

HCO ANNOUNCES 1/A RNG 3860, DF 2825

INSTRUCTOR NOTE: Have students follow you as you complete the initial fire commands through charge, asking for each command in order from class.

The following commands are recorded and announced by the computer:

WARNING ORDER FM, MF: PLT ADJUST, CHG 2.

Explain that the computer sends as much of the initial FIRE COMMANDS as he can. The HCO determines chart data from his surveyed firing chart, so that when called upon, he has both 1/A range and deflection that the computer will need for the initial firing data.

INSTRUCTOR NOTE: Explain again that the elevation is needed to determine drift so we can correct chart deflection to get deflection to fire. Show the range again on the record of fire and have students set this range on their GFTs. Request a student announce elevation. Ask for a check on the elevation, before pointing out where it goes and place it on the record of fire.

ELE 459

DRIFT L11

GFT DF CORR R3
DFT L11
DF CORR L8

INSTRUCTOR NOTE: Show again how the DF CORR is determined in the computation block at the top of the record of fire. Question students on where we carry the DF CORR so we can apply it to chart DF and carry it down. Then add it to the chart DF to get a DF to fire.

DF CORR L8
CHT DF 2825
DF FIRED 2833

INSTRUCTOR NOTE: Explain the computation of VI in the computation block. Give the observer's Alt and the corrections to TGT ALT, to determine the TGT alt.

Also explain we need to subtract the PLT alt from the TGT alt to get the VI. Involve the students in determining this information for the VI.

OBS ALT 456
(D) -30
TGT ALT 426
PLT ALT 361
VI +65

Ask again for the site from a student and request that all students determine this, so they get more practice and act as a check for the site. When the correct site is determined proceed by pointing the block out again for it and placing it in the site block.

SITE +24

Ask students for QE.

SI +24
ELE 459
QE 483

INSTRUCTOR NOTE: When quadrant is given show the block where it goes and place it in if it is correct. Ask students to send this command to the guns. Reinforce the earlier instruction on the gun having permission to load and fire the weapon for this mission because no restrictive commands have been given. Ask student for data to record in the in EFF block.

2rds VT

INSTRUCTOR NOTE: Explain the record of fire is policed as it was in the last mission and point out the 100/R block, requesting it from all the students.

Explain the fact that 20/R is not used for a VT mission, because it uses a 7-12 meter height of burst fuze for the effects. Using the fire order, remind the students that we will be adjusting with HE/Q and then firing for effect with VT fuzes.

100/R 26

Give the angle T as the chart operator would to the nearest 10 mils and ask if it is sent or just recorded. Pointing out the block where angle T gets recorded.

ANGLE T (580)600

Explain the extracting of probable error in range again from TFT and request it from the class.

Reinforce that it needs to be sent if it meets the requirement (= or > to 38 meters). Show the block and procedure to record it for the classroom purposes again placing it in the block.

PER (<38)
(29)

Explain that the time of flight needs to be determined even if the mission is not an aerial observer mission, high angle mission, a copperhead mission, moving target, or the fact that the observer did not request it.

TOF (20)

Explain the transferring of DF CORR and site to the subsequent fire commands block of the record of fire, pointing the blocks out and requesting the data from the class prior to placing it in.

DF CORR L8 SI +24

Explain the observer's subsequent corrections block again and announce the subsequent corrections from the observer. Request a student or the class read back the corrections while you send them in the observer's role.

OBS CORRECTIONS
L80 -200

Explain and give the chart data pointing out where it would be placed on the record of fire before placing it in.

After placing in chart data explain again the other blocks and request the deflection be determined and sent to the guns by the class. Read the deflection back if it has been determined correctly and police the DF CORR and chart deflection to determine the deflection to fire. Then request quadrant and once given place the data in responding with the read back as the howitzer section would.

HCO ANNOUNCES 1/A RNG 3740, DF 2873

DF FIRED 2881 QE 462

INSTRUCTOR NOTE: Ammo count is cumulated, observer is informed of the mission being fired and the howitzer section report is acknowledged and the ammunition is circled indicating it has been fired. Then begin the same procedure as previously done where they would wait for the observer to give his subsequent corrections. When received place these in the observer subsequent block. After the chart data is determined and

announced, the computer determines fire commands and sends them to the howitzer section.

AMMO EXP 2

OBS CORR +100

Again the subsequent fire commands are determined following the above procedures.

HCO ANNOUNCES 1/A RNG 3820, DF 2858

DF FIRED 2866 QE 476

OBS CORR +50 FFE

INSTRUCTOR NOTE: The ammo count and reports are done again. By this point you should be getting good response from the students. It now needs to be explained that the Obs is requesting we shoot all of our guns on his correction because the bracketing is completed and the next time we fire we will hit the target. Explain how the method of fire is changed now to PLT 2 rounds and fuze VT to include getting the TI setting and the block in which it is placed.

MF,Sh,Chg,Fz	**TI**	**DF FIRED**	**SI**	**ELE**	**QE**	**AMMO**	**TYPE**
		2866	+24	452	476	3	Q/
PLT 2 FZVT	**20.0**	**(2866)**	**+24**	**459**	**483**	**8**	**VT/**

OBS REPORTS END OF MISSION

MF,Sh,Chg,Fz
EOM

HE/TI

INSTRUCTOR NOTE: At this time a new mission will be initiated. The students will be using the same GFT setting for this mission.

ISSUE THIS CALL FOR FIRE.

N81 de N82, AF k
GRID 632 382 k
ENEMY OP, ICM I/E k

FDO FIRE ORDER: 2rds, CHG 2, TI i/e

INSTRUCTOR NOTE: Place this on the record of fire again explaining that this is the driving force behind all missions and that is tells us exactly how to attack the target.

Go through the standard fire order elements, briefly, again so students don't forget. Explain that only the elements that are changed or are required are announced. The method of fire for effect, which at a minimum lets the FDC know that indeed, a fire order has been issued. Continue on by explaining at this point things happen simultaneously, the HCO determines chart data, the VCO determines site, the RTO determines and announces the message to observer, and the computer sends the initial fire commands. State that you will practice each in steps starting with the sending of the message to observer. Ask students what the last target number was. Refer to the FO standards that request the next available and place it in the administrative block of record of fire.

NEXT TARGET # GD 1003

MTO N, TI i/e, 2rds, TGT NO GD1003

Announce chart data playing the role of the HCO and place it on the record of fire. The students will read it back playing the role of the computer.

HCO ANNOUNCES 1/A RNG 3160, DF 3425

INSTRUCTOR NOTE: Have students follow you as you complete the initial fire commands through charge, asking for each command in order from the class.

The following commands are recorded and announced by the computer:

WARNING ORDER FM, MF PLT ADJUST, CHG 2.

Explain that the computer sends as much of the initial FIRE COMMANDS as he can. The HCO determines chart data from his surveyed firing chart, so that when called upon, he has both 1/A range and deflection that the computer will need for the initial firing data.

INSTRUCTOR NOTE: Explain again that the elevation is needed to get drift so we can correct chart deflection to get deflection to fire. Show the range again on the record of fire and have students set this range on their GFTs. Request a student announce elevation. Ask for a check on the elevation, then point out where is goes and place it on the record of fire.

ELE 348

DRIFT L8

GFT DF CORR R3
DFT L8
DF CORR L5

INSTRUCTOR NOTE: Show again how the DF CORR is determined in the computation block at the top of the record of fire. Question students on where we carry the DF CORR so we can apply it to chart DF and carry it down, then adding it to the chart DF to get a DF to fire.

DF CORR L5
CHT DF 3425
DF FIRED 3430

INSTRUCTOR NOTE: Explain the computation of VI in the computation block. Give the TGT and Platoon's Alt. Explain we need to subtract the PLT alt from the TGT alt to determine the VI. Involve the students in determining the information for the VI.

TGT ALT 390
PLT ALT 361
VI +29

Ask again for the site from a student and request that all students determine it so they get more practice and act as a check for the site. When the correct site is determined proceed by pointing the block out again for it and placing it in the site block.

SITE +11

Ask students for QE.

SI +11
ELE 348
QE 359

INSTRUCTOR NOTE: When quadrant is given show the block where it goes and place it in if it is correct. Ask students to send this command to the guns. Reinforce the earlier instruction on the gun having permission to load and fire the weapon for this mission because no restrictive commands have been given. Ask student for data to record in the in EFF block.

2rds TI

INSTRUCTOR NOTE: Explain the record of fire is policed as it was in the last mission and point out the 100/R block requesting it from all the students. Explain that 20/R is used for a TI mission to correct the QE for a 20 meter height of burst. Using the fire order for a

reminder, remind the students that we will be adjusting with HE/Q and then firing for effect with TI fuzes.

100/R 32
20/R 6

Give the angle T as the chart operator would to the nearest 10 mils and ask if it is sent or just recorded, pointing out the block where angle T gets recorded.

ANGLE T (310)

Explain the extracting of probable error in range again from TFT. Request it from the class reinforcing that it needs to be sent if it meets the requirement (= or > to 38 meters). Show the block and procedure to record it for the classroom purposes again placing it in the block.

PER (<38)
(21)

Explain that the time of flight needs to be determined even if the mission is not an aerial observer mission, high angle mission, a copperhead mission, a moving target, or the fact that the observer did not request it.

TOF (16)

Explain the transferring of DF CORR and site to the subsequent fire commands block of the record of fire pointing the blocks out and requesting the data from the class prior to placing it in.

DF CORR L5 SI +11

Explain the observer subsequent corrections block again and announce the subsequent corrections from the observer. Request a student or the class read back the corrections while you send them as in the observer role.

OBS CORRECTIONS
L100 +200

Explain and give the chart data pointing out where it would be placed on the record of fire before placing it in. After placing in chart data explain again the other blocks and request the deflection be determined and sent to the guns by the class. Read the deflection back if it has been determined correctly and police the DF CORR and chart deflection to determine the deflection to fire. Then request quadrant. Once given place the data in responding with the read back as the howitzer section would.

HCO ANNOUNCES 1/A RNG 3230, DF 3440

DF FIRED 3445 QE 369

INSTRUCTOR NOTE: Ammo count is cumulated, observer is informed of the mission being fired and the howitzer section report is acknowledged and the ammunition is circled indicating it has been fired. Then begin the same procedure as previously done. The students will wait for the observer to give his subsequent corrections and again place these in the observer subsequent block. After the chart data is determined and announced the computer determines fire commands and sends them to the howitzer section.

AMMO EXP 2

OBS CORR -100

Again the subsequent fire commands are determined following the above procedures.

HCO ANNOUNCES 1/A RNG 3180, DF 3438

DF FIRED 3443 QE 362

INSTRUCTOR NOTE: The ammo count and reports are done again. By this point you should be getting good response from the students. They will need to change the fuze from quick to time so the Obs can correct the height of burst for maximum effects.

OBS CORR +50 FZ TI

HCO ANNOUNCES 1/A RNG 3200, DF 3439

DF FIRED 3443 SI +11 ELE 351 QE 362 3 Q

FZTI TI 15.0 DF FIRED 3444 HOB CORR +6 SI +17 ELE 354 QE 371 1

The ammo is started to be cumulated with the new fuzes and the FDC again waits for another correction. While policing the ROF the Delta FS corresponding to Fs 15.0 is determined and recorded in the Delta FS block.

DFS 0.14

OBS CORR U40

The computer then uses the Delta FS to determine the Fs CORR for an U40 showing his work in the lower computation block**.**

OBS CORR U40 -:- 10 = 4 x (Delta FS) 0.14 = (FS CORR) 0.56 ~ 0.6

The FS CORR is then brought up to the firing data and applied to the last FS fired, using the acronym USDA (Up Subtract, Down Add).

FS CORR	TI	CHTDF	DFCORR	DF FIRED	HOBCORR	SI	ELE	QE	AMMO
	15.0	3439	L5	3444	+6	+17	354	371	1
-0.6	**14.4**			**(3444)**				**371**	**2**

The ammo is to be cumulated with the new fuzes and the FDC again waits for another correction.

OBS CORR D15, FFE

The computer then uses the Delta FS to determine the FS CORR for an D15 showing his work in the lower computation block**.**

OBS CORR D15 -:- 10 = 1.5 x (Delta FS) 0.14 = (FS CORR) 0.210 ~ 0.2

The FS CORR is then brought up to the firing data and applied to the last FS fired, using the acronym USDA (Up Subtract, Down Add).

MF,Sh,Chg,Fz	**FS CORR**	**TI**	**DF FIRED**	**QE**	**AMMO**	**TYPE**
	-0.6	**14.4**	**(3444)**	**371**	**2**	
PLT 2rds	**+0.2**	**14.6**	**(3444)**	**371**	**10**	**TI/**

INSTRUCTOR NOTE: Explain how the method of fire is changed now to PLT 2 rounds to include the block in which it is placed.

OBS CORR END OF MISSION

EOM ANNOUNCED TO THE GUNS

INSTRUCTOR NOTE: Explain the administrative data that is filled in on the ROF.

DPICM

Two ICM projectiles are provided for the 155mm howitzer. M449A1 APICM, provides anti-personnel fragmentation at the target from 60 M43 grenades which are expelled from the base of the projectile while it follows a ballistic trajectory over the target. M483A1 DPICM, provides anti-personnel and anti-armor grenades. DPICM contains 64 M42 anti-armor and 24 M46 anti-grenades. Both grenades contain a shaped charge capable of penetrating 2.75 inches of armor. The M46 anti-personnel grenades are scored on the inside to provide a more even fragmentation.

The following are major points and differences concerning the ICM projectiles as compared to HE:

1. The trajectory to the target is a two part trajectory.

    a. Ballistic trajectory from muzzle to submunition expulsion.

    b. Free fall of submunitions from expulsion to burst at the target.

2. The manual computations require computation of data for a base projectile and extraction of firing data, based on the base data from appropriate addendum or additional GFT scales

3. The empty projectile canister continues to follow a ballistic trajectory past the target and may prove to be a hazard to friendly elements operating down range.

MANUAL ICM COMPUTATIONS

It must be noted that DPICM is the base projectile of a family of projectiles. As such this projectile is provided when fired in the self-registering mode (as a bursting spotting round for adjustment and registration). This TFT provides the base data for DPICM, which may be converted to casualty producing air burst with data from the addendum J-1. To avoid adjustment of fire with the expensive, high casualty producing DPICM round, the ballistic research laboratory created the R-1 addendum to the AM-2 TFT. This allows the user to adjust with HE (a ballistically dissimilar round) and fire for effect with DPICM. The AN-1 technique is still valid, however the R-1 technique/and the DPICM scales on the AM-2 GFT. This addendum and graphical scales are preferred because of the savings in ammunition and the more accurate muzzle velocities upon which the newer addendum is based.

INSTRUCTOR NOTE: Brief students on how/what you are going to do to determine DPICM data and how it will be recorded on the ROF. Taking this approach will inform them that the data will be recorded differently on the ROF and they will not get ahead of you by placing the data in the wrong place. And then issue the following GFT setting.

GFT 1/B, CHG 4, LOT A/G, RANGE 4500, ELE 280, TI 15.1
TOT DF CORR R4 GFT DF CORR R9

Issue the following CFF on the board and have students or selected student respond as RTO and the Computer alerting the howitzers.

N81 de N82, FFE k
Grid 794 372 k
BMP co assembling, Ti k

FDO issues the following fire order and the computer records it on the Record of Fire (ROF).

AMC, 3RDS, DPICM, LOT F/G

INSTRUCTOR NOTE: Go back and explain to students that because observer asked for HE/TI and the FDO wants to fire DPICM, he must announce shell and lot in the FO to change his FO standards. Then show students that had observer ask for ICM and FDO agrees all he must address in the FO is the lot, which will tell to change the shell also.

Have students determine and announce the MTO:

N, ICM, 3RDS, TGT NO GD1004

HCO ANNOUNCES 1/B RNG 4650, DF 3308

Students record the initial chart data on the ROF.

Complete the ROF through FZ of the initial FC's. The computer will complete the ROF initially just like any other mission to include the CFF, FO and MTO.

Once the computer has announced the FC's through the FZ he will now compute the HE data and record it on the ROF. You must record the following in the MF, SH, Chg, FZ block in the Subsequent Fire Commands Block in parentheses: **(DPICM DATA)**

INSTRUCTOR NOTE: Again remind the students where the HE data is recorded on the ROF.

Using STEP 1 of the 3 step method have students set MHL over CHT RNG 4650 and det'm HE FS: **15.7** under the Time gage line and record in the TI block and place it in parentheses, as it will not be announced it to the howitzers.

Now have them det'm the HE ELE: **293** under the elevation gage line and record it.

From here we need to det'm PLT VI and compute site so we can det'm HE QE. Using the upper computation block have students lock step through recording and determining PLT VI:

VCO announces **TGT ALT 460**
PLT ALT 435
VI + 25

Have student or selected student compute and announce site for this mission. Site is determined and announced as: **+6**. Record the site in site block and algebraically add it to HE ELE for HE QE: **299** and record HE QE in left side of the QE box. The right side of the block you will record (HE DATA) making sure it is in parentheses.

INSTRUCTOR NOTE: Have students record the GFT DF Corr in the upper computation block in preparation for determining DPICM DF Corr. Once you have done this point out to students that they have finished determining he data and are now ready to det'm DPICM firing data.

Determining DPICM data with the graphical scales has 2 steps. First explain to students once they have completed determining HE data then the TI and ELE gage lines are no longer used.

STEP 1. To det'm DPICM FS place the MHL over the HE FS (that's recorded in the Ti block) on the M582/TOF scale. (Have students do this now).

INSTRUCTOR NOTE: Remind students of how the DPICM FS scale is graduated, one increment for 0.5 seconds and point out that they must visually interpolate to the nearest 0.1 sec.

With the MHL over the HE FS read up the MHL to the DPICM M577 FS scale (bottom scale for proj M483A1), and det'm DPICM FS: **15.7** and record it in the gray shaded TI block of the Subsequent Fire Commands.

Point out to students that next we will need DF FIRED but in order to get the DF CORR we must det'm DPICM DF CORR and algebraically add it to the GFT DF CORR to get our DPICM DF CORR and then introduce STEP 2.

STEP 2. Place the MHL over the HE QE (recorded in the QE block) on the HE ELE scale (have students do this now). With the MHL over the HE QE read up the MHL to the DPICM DRIFT SCALE (top of the scales for proj M483A1) and det'm DPICM DFCORR: **L 7** and record it in the upper computation block under GFT DF CORR. Have student algebraically add for DF CORR:

GFT DF CORR R 9
DPICM DF CORR L 7
DF CORR R 2

Bring down the answer to the DF CORR block above the CHT DF. Have student add the DF CORR to the CHT DF:

DF CORR	**R 2**
CHT DF	**3308**
DF FIRED	**3306**

Record DF Fired in the gray shaded DF FIRED block of the initial Fire Commands and put parentheses around it as you will not sent it to the howitzers.

INSTRUCTOR NOTE: Point out to students that they are still in step 2 and the MHL doesn't move off the HE QE. Remind students of how DPICM QE scale is graduated, one increment for 5 mils and they must visually interpolate to the nearest 1mil.

To det'm DPICM QE read up the MHL to the DPICM QE scale (middle scale for proj M483A1). Determine the DPICM QE: **384** and record it in the gray shaded QE block of the initial Fire Commands.

Once the computer starts the FC'S changes will start taking place. As normal the **warning order "FM" will be announced and recorded on the ROF.** The **MF** will change from **"PLT ADJ" to "PLT 3rds"**. Special instructions **"AMC"** is issued as we normally would, the shell, lot, and FZ issued in the Fire Command Standards has now been changed by the FO and must be announced to the guns: **"SHELL DPICM", "LOT F/G", "CHG 4", "FZ TI", TI 15.7, DF 3306, QE 384.**

At this time reinforce to students that with a FFE mission there is no in effect SH/FZ, RDS announced to the guns and that the block remains empty.

Once we have determined and announced the initial DPICM firing data we will go on and police the ROF. Pay careful attention to point out the items we not determine for DPICM.

DFS Not needed as this is for correcting, m582 fz only

20/R Not needed as we will be firing data that, has the hob corr already incorporated in. But for classroom proposes we will be determining and recording it.

AMMO EXP **I**s determined (reinforce PLT 3 X 4guns = 12 rds).

TOF Is determined (using the R-1 Add, described in the next paragraph).

PER Not determined in class (we do not have AN-1 TFT).

ANGLE T Is determined if direction is known, announced as normal.

DF CORR for SUB CORRS- Brought down even though it is a FFE MSN in order to be responsive if observer makes corrs for a repeat.

SITE FOR SUB CORRS- Same as DF CORR for subs

ADMIN DATA- Will be completed as soon as the guns report shot on the initial volley

INSTRUCTOR NOTE: Do not have guns report shot at this time. Shot will be given following explanation of R-1 Addendum and extraction of TOF to complete policing the ROF. Transition to the R-1 add by restating that the DPICM proj has a two part trajectory; the ballistic trajectory of the canister and the free fall of the sub munitions to the tgt , use board drawing to show both parts.

While doing the board drawing explain to students that the TOF for DPICM corresponds to the ballistic trajectory from the muzzle of the weapon to the expulsion of the sub munitions; and then the free fall from expulsion of sub munitions to the burst of munitions at the target and therefore must be extracted from the R-1 ADD not the GFT. Introduce the students to the front cover of the FT 155 ADD-R-1. Explain cover pointing out to students that this ADD corrects HE data determined using a GFT setting on the GFT 155mm AM-2 to DPICM data and that it also is used to det'm HOB corr to apply to DPICM data for OBSERVER HOB corrections. Moving to the inside the R-1 ADD we find the ADD divided into 3 sections, Table of Contents, Introduction and Tabular Firing Tables.

TABLE OF CONTENTS- Gives use a list of every item contained in the ADD by paragraph and page number.

INTRODUCTION- Gives us General Information on where, when and how the ADD was created and it's applicability on page III. Pages IV-VI gives us instructions on how to extract data for the firing tables and how to apply that data for the DPICM projectile.

Have students turn to the Tab CHG 4G. The Chg currently is being used in the initial firing data. At Tab Chg 4G point out to students that there are only two tables.

TABLE A- Corrections to QE and supplemental data

TABLE B- Corrections to FS

Open table A and identify columns 1-8 briefly explaining each:

COL 1- Entry argument used by entering with HE QE to the nearest 5 mils.

COL 2- To correct HE QE to DPICM QE if you are not using the DPICM Graphical Scales.

COL 3- Used to change the trajectory for an increase of 50M HOB, point out that the values listed in the ADD are in black so they are POS (+) values which correct for an increase in height. For a down correction change the value to the opposite sign Negative (-).

COL 4- To change the trajectory for increase of 100M in range. Point out the same POS (+), NEG (-) correlation as in col 3.

COL 5- Is the distance in meters the chart location may be displaced to correct for a low level wind of 1 knot.

COL 6- Is the value in seconds/tenths of seconds for the two part trajectory.

COL 7- Is the value in meters for range to impact of the empty projectile canister after the submunitions have been expelled.

COL 8- Is the correction in mils for DPICM DRIFT to be added to HE DRIFT if you are not using the DPICM Graphical Scales on the AM-2 GFT.

After completing table Alpha open ADD to table Bravo and explain columns 1-4 briefly.

COL 1- Entry argument used by entering with HE M582 FS. Point out col 1 is setup by inclusive numbers.

COL 2- Used to correct HE M582 FS to DPICM FS if Graphical Scales on AM-2 GFT are not used.

COL 3- Used to correct DPICM M577 FS for an increase of 50M in HOB. Again point out values are black and therefore are POS (+) and are for an increase or UP correction. For a decrease or DOWN correction use opposite sign NEG (-).

COL 4- Used to correct DPICM M577 FS for an increase of 100M in range. Point out that col 4 has the same POS (+)/NEG (-) correlation as col 3.

INSTRUCTOR NOTE: Having explained the R-1 add point out that only columns 1,3, and 6 in table A and cols 1 and 3 in table B will be used.

Lock step students through determining TOF by first determining the entry argument. HE QE from ROF was 299 and the closet listed value is 300. Caution students to cross cols exactly on line with the HE QE 300 to extract TOF 27.1 expressed in whole seconds and record on ROF in parenthesis (27).

INSTRUCTOR NOTE: Talk students through guns firing so that ammo expended gets circled and admin data filled in since we have completed FFE.

Now set a scenario that tgt of BMP's having been fired upon begin to move and observer calls in a correction to engage the tgt again.

OBS CORR: DIR 1120, L 300, +200, U100, RPT k

HCO ANNOUNCES: 1/B RANGE 4900, DEFL 3386

Record observer corrections on ROF and explain how to set up ROF for subs corrs of DPICM. Place (HE) in parenthesis on the second line in the gray shaded MF, SH, CHG, FZ block. Place (DPICM) in parenthesis immediately below HE. Place (DP CORR) in parenthesis immediately below DPICM.

Once ROF has been set for subs corrections lock step students through recording the HE and DPICM on the appropriate lines, placing all data determined in parenthesis.

MF,SH, CHG,FZ	FS CORR	CHT TI	DF DEFL	CORR	FIRED	HOB	SI	ELE	QE
(HE)	**(16.7)**	**3386**	**R2**	**(3384)**		**+6**	**312**	**(318)**	
(DPICM)	**(16.9)**			**(3384)**				**(405)**	
(DPCORR)									

Enter R1 ADD to TAB Chg 4G table B and lock step them through extracting FS corrections, recording value on ROF and apply it to DPICM FS. Enter table B col 1 with HE FS determined and recorded on first line of subs Fire Commands (16.7). FS in col 1 will be between 16.6-17.1, cross over to col 3 and extract correction **+0.1**. Reinforce to students that this corr is for an increase of 50M and observer HOB correction is U100, so they will need 2 times this value. Have students do math for HOB corr to FS in lower computation block.

+0.1 R-1 FS CORR
X 2 FOR EACH 50M HOB CORR BY OBS
+0.2 TOTAL DP CORR FOR FS

Record this value +0.2 in FS corr block on line with (DP CORR) and add it to DPICM TI for FS to fire.

MF,SH, CHG,FZ	FS CORR	CHT TI	DF DEFL	CORR	FIRED	HOB	SI	ELE	QE
(HE)	**(16.7)**	**3386**	**R2**	**(3384)**		**+6**	**312**	**(318)**	
(DPICM)	**(16.9)**			**(3384)**				**(405)**	
(DPCORR)	**+0.2 17.1**			**3384**					

INSTRUCTOR NOTE: Since there is no Corr to DF, have students bring down DF Fired and not put it in parenthesis. Using lock step have students turn to table A and extract HOB Corr to QE, record value on ROF and apply it to DPICM QE.

Enter table A col 1 with HE QE determined and recorded on first line of sub Fire Commands. (318) expressed to nearest 5 mils **320.** At QE 320 cross table to col 3 and extract corr **+12.0**. Again reinforce that corr is for an increase of 50M and value must be multiplied by 2 for observer corr U100.

+12.0 R-1 QE CORRECTION
X2 FOR EACH 50M HOB CORR BY OBS
+24.0 TOTAL DPICM CORR FOR QE

Express value to whole mil **+24** and record this value in the HOB corr block and apply it to DPICM QE for QE to fire.

MF,SH, CHG,FZ	FS CORR	CHT TI	DF DEFL	CORR	FIRED	HOB	SI	ELE	QE
(HE)	**(16.7)**	**3386**	**R2**	**(3384)**		**+6**		**312**	**(318)**
(DPICM)	**(16.9)**			**(3384)**					**(405)**
(DPCORR)	**+0.2**	**17.1**			**3384**	**+24**			**429**

Have students now place cumulative ammo count in AMMO EXP block **24.** At this time guns can fire corrected data, ammo count circled and observer calls **EOM**. Have students record EOM to guns and police the ROF. The police should be nothing more than identifying ammo exp by type and up dating ammo board.

INSTRUCTOR NOTE: Having completed ROF review key steps and answer any questions. Be sure to point out the signed values of FS correction and HOB corrections from R-1 add that they do not work the same as HE/TI.

PRECISION REGISTRATION

INSTRUCTOR NOTE: Discuss why we register and what registrations account for.

WHY REGISTER ?

1) To correct for NONSTANDARD CONDITIONS.
2) To correct for ERRORS IN UNIT LOCATION.
3) To correct for ERRORS IN LAY.
4) To correct for ERRORS IN THE FIRING CHART.
5) To correct for PERFORMANCE DIFFERENCES IN AMMUNITION LOTS.

INSTRUCTOR NOTE: Discuss the pros and cons of precision registration.

REG ADVANTAGES	REG DISADVANTAGES
Don't need measurement of standard conditions	Requires surveyed point Expends ammo w/o damage to enemy Subjects PLT to tgt acq.

PRECISION REGISTRATION

In a precision registration the observer is directed in a MTO to conduct an adjustment on a known point. Then the FDC will determine the total correction from chart (should hit) data to adjusted data (did hit data) that actually hit the registration point). The perfect situation would be for the observer to adjust until he achieved a target hit. This is unlikely because of errors. These errors are one of three types of errors that effect our firing.

HUMAN ERRORS CONSTANT ERRORS INHERENT ERRORS

INSTRUCTOR NOTE: Explain the three types of errors briefly .

1. Human error results from lack of proficiency. These may range from such errors as wrong fuze settings or errors such as improper sight picture on the part of the gunner. Human errors are eliminated through training and supervision.

2. Constant error is that degradation of accuracy caused by constant non-standard factors influencing the firing. An example of Constant Error would be an error in the survey used to locate the aiming circle location used in laying the PLT. Constant errors remain unchanged for a long enough period to be consistent during a course of firing. It is these constant errors that we correct for by met computations and registration.

3. Inherent error is a variable error from round to round that results from round to round inconsistencies in the ammunition manufacture and weapon reaction to firing.

INHERENT ERRORS ARE NOT CORRECTABLE!

Their effect is dispersion of rounds fired about a mean point of impact. This is most easily visualized as the craters left in a flat field after 100 rounds have been fired at the same deflection and QE.

INSTRUCTOR NOTE: Briefly mention the probable errors from table g of the TFT. Students will not be shown in detail how probable errors are determined. This is lengthy and irrelevant to the registration procedures they will be doing. A slide of the entire box may be shown if a request to see how the error determination for range or DF is done.

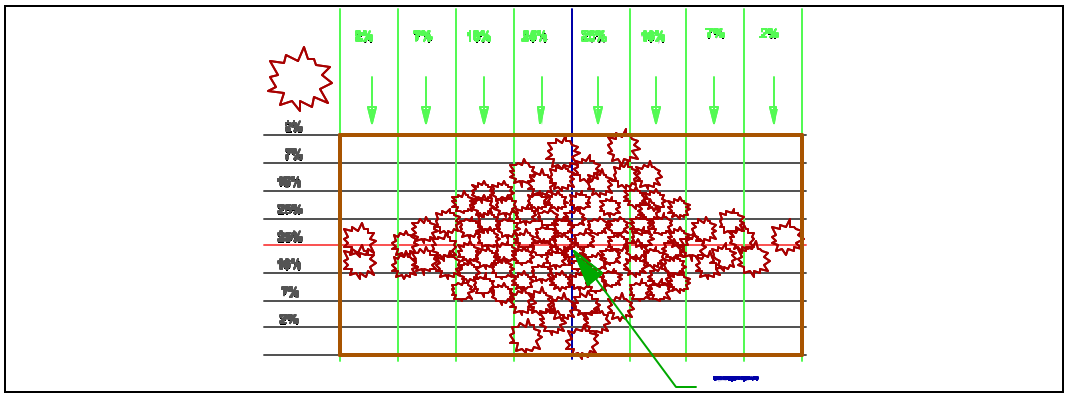


Figure 1 100% RECTANGLE WITH ERROR FOR DEFLECTION AND RANGE

We are willing to accept a bracket of four rounds versus a target hit because of the probability of not hitting the target.

INSTRUCTOR NOTE: Drop the demo explaining the objective of the impact portion of a precision registration is to establish spottings of two overs and two shorts within 25 meters of each other. If pe_r is > or = 25 meters, the bracket established is 50 meters.

INITIATE THE REGISTRATION.

Unlike area fire missions, the precision registration is initiated by the FDC upon the FDO's decision to register. The FDO will issue a fire order to the FDC To announce the decision to register.

The fire order will follow this format:

WHAT	**PRECISION REGISTRATION**
WHERE	**ON KNOWN POINT 01**
WITH WHOM	**W/ OBS H64**
UNIT TO FIRE	
ADJUSTING ELE MOF PROJ LOT & CHG FUZE	**Q & TI**
BASIS FOR CORRECTION	
DISTRIBUTION	
SPEC INSTRUCTIONS	**UGQ**
PROJ I/E	
LOT & CHG I/E	
FUZE I/E	
TGT NUMBER	

INSTRUCTOR NOTE: The FDO may not have a KNPT to select for a registration and may request that the observer define a point to register on and locate it to the nearest 10 meters within the vicinity of a selected grid location.

Upon hearing the Fire Order the RTO composes and sends the MTO using the following format:

WHAT	**PRECISION REGISTRATION**
WHERE	**ON KNOWN POINT 1**
FUZES	**Q & TI**
TGT #	
ADDITIONAL INFO TRAJ ANGLE T PER TOF	

FDC PREPARATION.

Upon hearing the fire order the HCO plots the target and determines chart data as in an area mission.

INSTRUCTOR NOTE: The target would simply have to have a pin placed in it because our registration points are normally given as known data and placed on the chart as part of construction of firing charts.

The VCO determines site as he would do in an area fire mission and announces it to the computer when called upon. The computer determines and records the data on the record of fire while announcing initial fire commands to the registering gun.

INSTRUCTOR NOTE: The registering gun would normally be the gun that is closest to the geographic center of the platoon. This piece is normally the average shooting strength weapon of the platoon as well.

CONDUCT OF THE REGISTRATION.

INSTRUCTOR NOTE: Inform the students that at this point the mission is processed like all fire missions.

After establishing the 25m bracket,(if PE_R IS < OR = 25m), and accomplishing the objective the observer would then send refinement data that would place the last round on the target if it were fired.

This is applied by the FDC to determine the adjusted or (did hit data). If the registration is ended here, the FDC determines corrections for deflection and elevation.

The HCO determines the chart range and deflection for this refinement correction and sends it to the computer but firing data is not sent to the gun. The deflection to fire is determined and circled and the elevation is determined and circled. Quadrant WILL NOT be determined because this data is not sent to the gun.

INSTRUCTOR NOTE: Stress that the deflection and elevation from the refined deviation and range are circled on the record of fire and not fired.

To determine the time portion of the GFT setting, the mission is continued by changing the fuze to time. The observer will request to record as registration point # Time repeat. Data is determined from the adjusted data from the impact phase. 20/R is added to the last site fired to correct for HOB. This value is total site, which is applied to the Adjusted Elevation to determine a new quadrant for the time portion of the mission if no further corrections are given in deviation and or range.

INSTRUCTOR NOTE: Explain how we changed the fuze in a time mission during mission processing when we wanted the gun to place a different fuze on the shell through issuing fire commands. FZ TI if the HOB is not correct the observer will adjust the fuze setting through up or down corrections. The computer will use delta fuze setting to determine the FS.

The computer must change the fuze to time and give the time setting to the howitzer firing the registration.

The observer will send UP 40 corrections until an airburst is observed. When the observer spots the first airburst, he will request three rounds be fired with the same data. The observer will use these four rounds to determine refinement to bring the HOB to 20 meters. When the Computer receives the refinement, the adjusted time is determined and recorded but no additional rounds are fired.

INSTRUCTOR NOTE: The students should be aware that the observer's request for three rounds during the time adjustment is always followed by time refinement even if all three rounds were to impact on the ground (graze burst).

When the refinement data is sent this keys the FDC that the gun is no longer required to fire any more rounds the majority of the time. The computer determines the adjusted fuze setting by applying DELTA FS to the refinement and determining the FS CORR. The FS CORR is applied to the last time fired and becomes the adjusted fuze setting. The Computer circles the adjusted fuze setting and no additional rounds are fired. At this point the registration should be complete.

DETERMINATION OF THE GFT SETTING AND TOTAL CORRECTIONS.

Once the FDC has determined and recorded the adjusted deflection , elevation and fuze setting, the FDC must turn this into a usable correction that may be graphically applied to the GFT. This is the GFT setting.

The GFT setting is put into the UCARET format followed by total and GFT deflection corrections:

U C A R E T
GFT 1/B, CHG 4G, LOT A/G, RG 5180, EL 336, TI 19.8

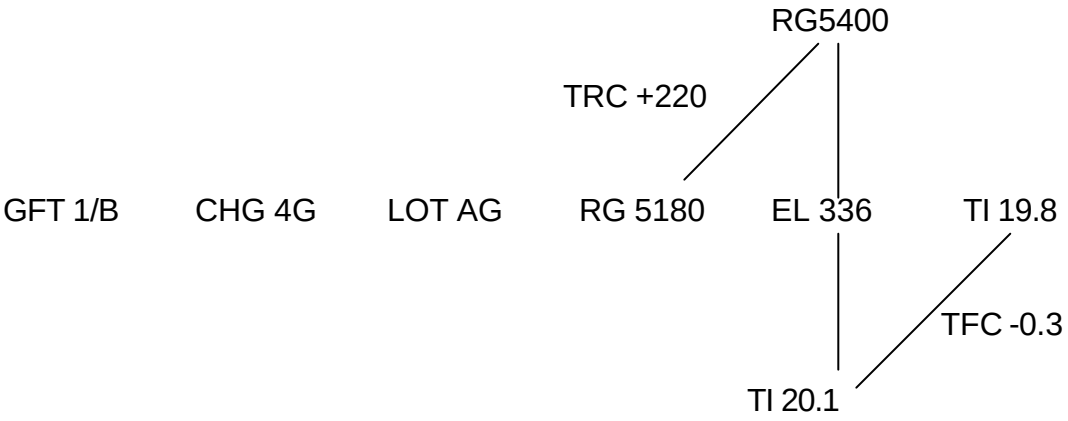
TOT DF CORR L11, GFT DF CORR L4,

The TOT DF CORR and GFT DF CORR are determined by the following procedures:

(SHOULD HIT) CHART DF 3233
(DID HIT) ADJ DF 3244
TOT DF CORR L11
(DFT AT ADJ EL) DFT L7
GFT DF CORR L4

INSTRUCTOR NOTE: Discuss how to determine total range and fuze corrections and very briefly explain that they are used in manual met computation.

In addition to the GFT setting, the FDC must determine the total correction applied to range and fuze setting. This is determined as the difference from chart to adjusted data. The lazy Z may graphically portray these differences. Drawn over the UCARET format, the LAZY Z provides a graphic representation of the work above. In addition we can determine the total range correction (TRC) and the total fuze correction (TFC)



Process EOM as you would any mission and subtract the ammo expended.

SPECIAL NOTES:

None

Section IV

PERFORMANCE

The students will reinforce the tasks taught through practice and additional controlled practical exercises if time restraints allow.

Section V

TEST EVALUATION PLAN FOR THIS EXERCISE

The material presented will be formally evaluated through graded homework and in GD1002 examination.